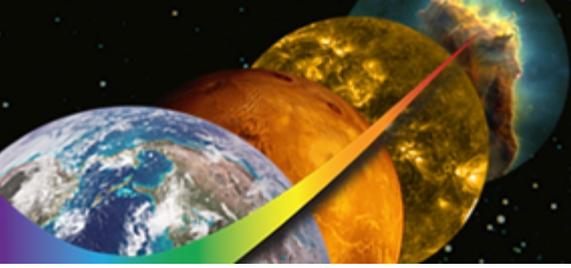




MBSE through the Project Lifecycle

Jessica Knizhnik
Synthia Tonn

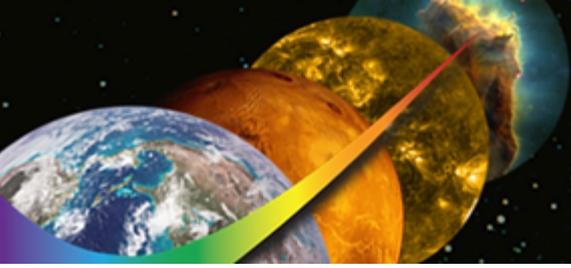




MBSE Definition

“The formalized application of modeling to support system requirements, design, analysis, verification and validation activities beginning in the conceptual design phase and continuing throughout development and later life cycle phases. MBSE is part of a long-term trend toward model-centric approaches adopted by other engineering disciplines, including mechanical, electrical and software. In particular, MBSE is expected to replace the document-centric approach that has been practiced by systems engineers in the past and to influence the future practice of systems engineering by being fully integrated into the definition of systems engineering processes.”

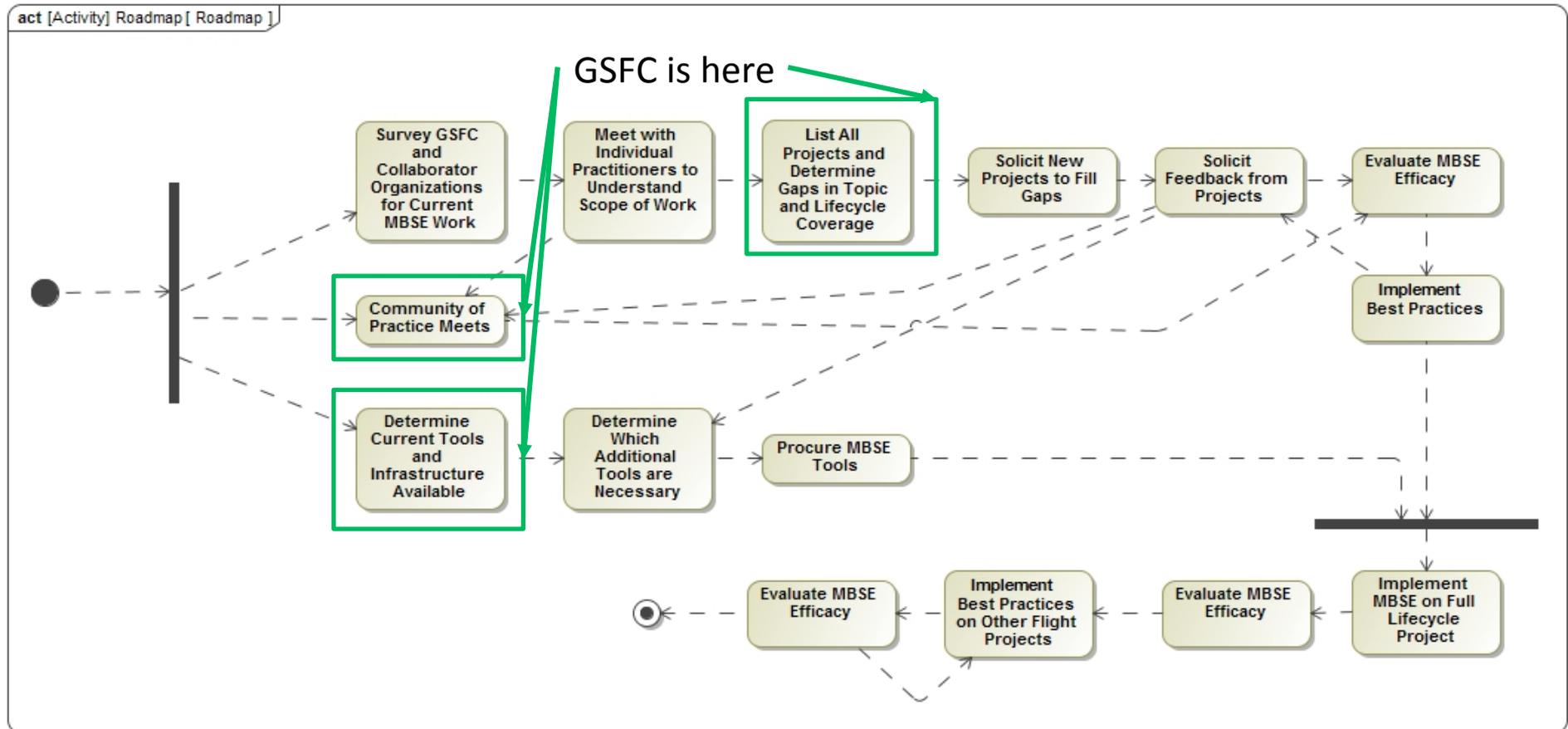
<http://www.omgwiki.org/MBSE/doku.php>

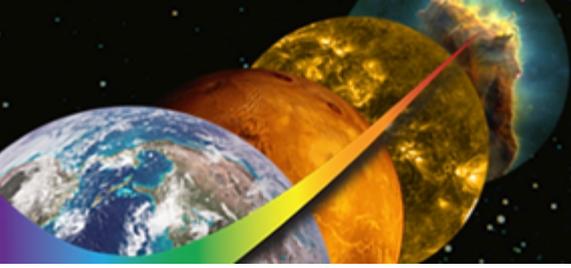


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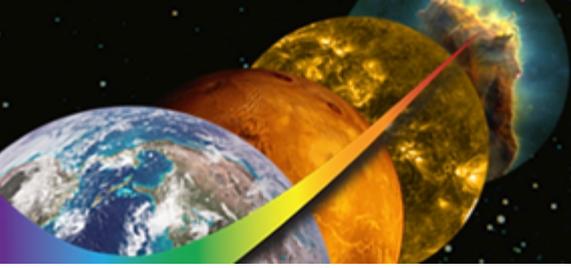
Roadmap





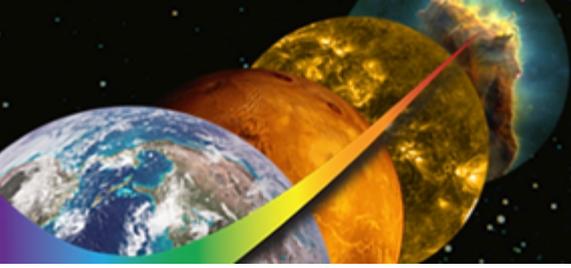
End States

- All projects use one model which acts as a single source of truth that all other project actions and decisions are based upon
 - All team members work from same version controlled model
 - Real time access to comprehensive project data repository across disciplines and stakeholders
 - All information centralized for decision making
 - Paperless model centric reviews
 - Requirements, test results and analyses tied in one model
- Leverage existing designs for new projects
 - Pre-Fabricated documentation
 - MELs, Proposals, SEMP, etc.
 - Linkages between disparate databases
- Robust community of practitioners for deployment to projects



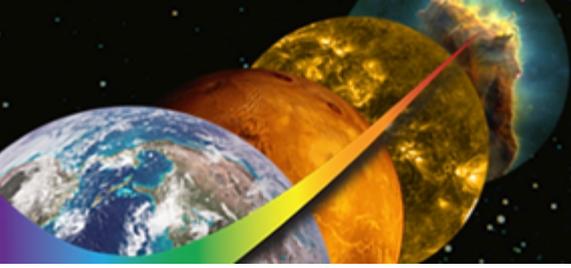
Pilot Studies

- Practitioners, in the course of regular project activity, produce white papers and best practices for:
 - Model development
 - Storage and management of models
 - Discipline specific ontologies
- Tailor next round of IRADs based on needs and opportunities identified
- Identify compartmentalized areas such as Failure Detection and Correction (FD&C) and contingency trees on flight projects to automate testing
 - Any systems level activity that could use executable test case models



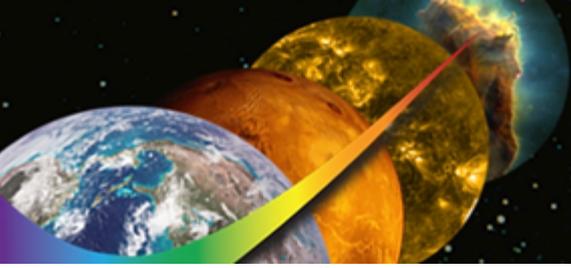
Pilot Studies

- Track projects through life cycle phases
 - Determine which products are useful to model and build models used not only for project value for also as representative model for demonstration and teaching
 - Our goal is to first fill in the map using artifacts from multiple projects, then to have a complete set of artifacts from an individual project
 - Build a center wide model repository for reference and reuse
- Current projects:
 - SCAN/450 Ground System (Ed Amatucci/592, Darryl Lakins/592, Robin Mauk/592, Jessica Knizhnik/373)
 - ARRM Project with JPL (Ben Cichy/599)
 - TIRS II (Synthia Tonn/543)
 - RESTOR (Jessica Knizhnik/373)
 - Sounding Rockets (Jessica Knizhnik/373)
 - CubeSAT (Lloyd Purves/599)
 - JPSS Ground System (Leslye Boyce/599 and Rob Morgenstern/581)
 - OSIRIS-REx Ground System (University of Arizona)
 - Space Geodesy Project (SGP) (Darryl Lakins/592)
 - Space Network (SN) – Development, Test and Training Facility (DTTF)
 - Space Network Ground Network Sustainment (SGSS)
 - UML and MBE on JWST (Gary Smith/581)
 - CATTENS (Steve Waterbury/585)
 - Model Based Mission Assurance (MBMA) (Tony Diventi/372)
 - IV&V (Marcus Fisher/180)



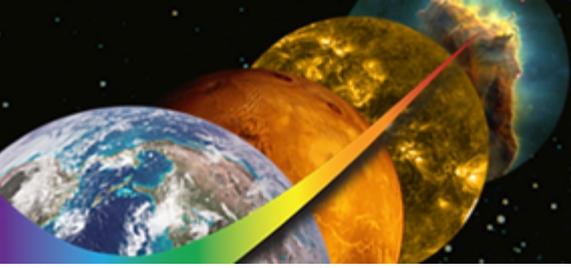
Collaboration – Leverage Agency and Other Centers

- Initial ontology and semantic development - take advantage of the agency/NESC work being doing at “more advanced” centers; ontology and semantic development should be performed by a team including practitioners
- Open source products being developed by JPL (per discussion with MSFC); bring into model repository or have a shared agency model repository. Learn how DocWeb and sharepoint are used for SE interface with modelers. Learn shared practices.
- Collaborations:
 - Astroid Redirect and Retrieval Mission (ARRM)/JPL+MSFC +GSFC (Ben Cichy/599 at GSFC)
 - NASA Integrated Model Architecture (NIMA)
 - INCOSE Working Group
 - NASA Agency Level Working Groups
 - Department of Defense
 - University of Maryland
 - Mars Habitat Project at JSC



Next Steps

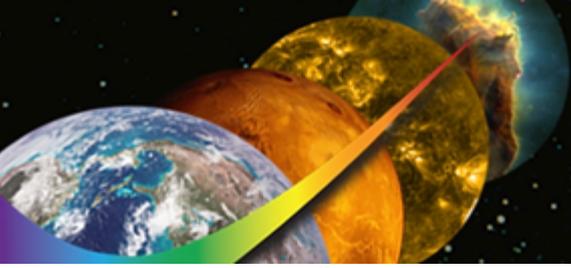
- Pilot Studies
 - Form new pilot studies at MBE workshop
 - Determine pilot study participants' support needs
 - Track pilot study progress and lessons learned
 - Begin new collaborations and strengthen existing ones
- Form MBE working groups
 - Determine best practices
 - Set up necessary infrastructure
- Evaluate needs for gaining institutional support



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Back Up



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MBSE Two Main Views

- Descriptive high level architectural, functional, operational, and programmatic models (qualitative architecture description)
- Integrated detailed discipline models

